Space Weather Forecast

Issued on Monday, 20 February 2023 at 12:53 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Awaited 17 February Coronal Mass Ejection from a strong-class X-ray flare arrived at Earth 20/1045UTC. Chance of Minor Geomagnetic Storm intervals (G1).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the past 24 hours, with frequent mid-level Common-class flares recorded. The largest of these flares was observed at 20/0702UTC from near the leading spot of a group in the northwest, with the spot group itself otherwise showing visual fading.

The above region was one of up to eight present on the Sun in the period, with up to two developing regions going some way to offset a departing region on the southwestern solar horizon. Of the current sunspot groups, the largest and nominally most potent spot group remains in the northeastern quarter of the Sun, with this spot responsible for the currently observed CME shock arrival arising from the Strong-class flare of 17 February.

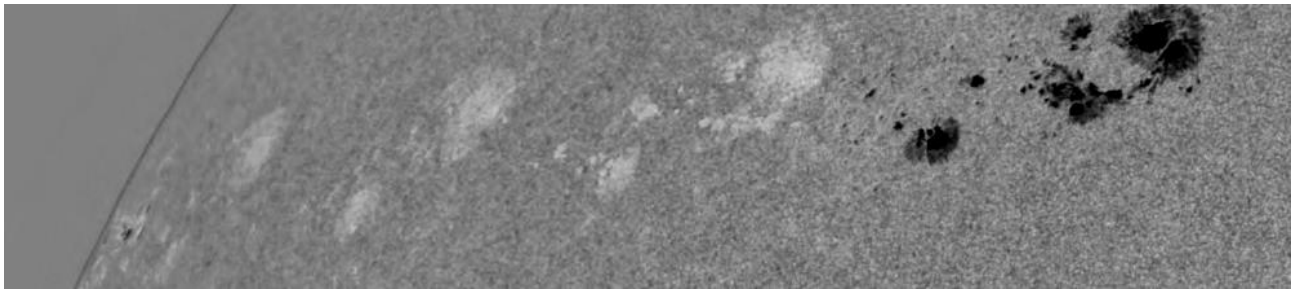

Figure 1: Helioviewer.org-generated visible light evolution of the footprint of the sunspot group responsible for the Strong X-ray flare of 17 February in 24-hour imagery steps (17, 18, 19/1200UTC steps in white; 20/1200UTC in black). Note the slight areal growth in the intervening time since the large flare.

New potential Coronal Mass Ejection (CME) candidates seen on imagery for the period included a 'prominence eruption' from the southwest during the UTC afternoon of Sunday 19 February, erupting from near a sunspot in this location. The track of this feature appears to closely follow an earlier CME from the southwest prior to the start of this 24-hour period (this earlier event being an analysed miss). The prominence eruption has been analysed as carrying a small chance of delivering a glancing interaction late on day 3 or early day 4 (Wednesday 22 or Thursday 23 February).

Also observed in imagery was late afternoon and early UTC evening northeastern solar horizon series of minor X-ray flares. This event has yet to be analysed, however any Earth-directed component is considered unlikely.

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Solar Wind / Geomagnetic Activity: Solar winds were mostly suggestive of a slow regime, but giving way to a probable arrival of the awaited shock from the 17 February Strong-class associated CME, manifesting at Earth-based magnetometers at 20/1045UTC, with BGS Hartland seeing a modest 15nT deflection in the H-component at this time (Sudden Impulse Alerts would normally be issued for disturbances nearer 60nT+).

As such, the solar wind speed mostly varied in Background levels, but showed a late increase to Slightly Elevated. The number of particles in the solar wind was also mostly in its normal Background range, but also increasing to Slightly Elevated levels after the CME shock arrival. The magnetic field associated with these particles showed a stable trend at first, giving way to a new higher magnitude level after the CME shock passed, becoming Slightly Elevated. The north-south component was variable, with no strong tendency toward being aligned or anti-aligned with Earth's field, although this too showed a greater amplitude after the CME shock passed.

The net result of the above solar wind measures was nevertheless for quiet geomagnetic activity, well below Minor Geomagnetic Storm G1, even after the CME shock's arrival.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Mainly low activity is expected. Isolated Moderate-class X-ray flares are likely, with a slight chance of rising again to high with further Strong-class flares - the main risk being from the sunspot that has produced them in the recent past in the northeastern quarter of the Sun.

Solar Wind / Geomagnetic Activity: In terms of CMEs, Earth is currently transiting a sector of space being affected by at least the shock from the 17 February CME, with a chance of Minor Geomagnetic Storm G1 for the remainder of the current UTC day. These winds should ease through day 2 (Tuesday 21 February). There is a very low chance of a further CME glance (from 19 February) later day 3 or day 4 (Wednesday 22 or Thursday 23 February), but this is currently not expected.

In terms of recurrent fast solar wind sources (from persistent 'coronal holes'), a slight enhancement may arise later day 2 or day 3 (Tuesday into Wednesday 22 February).

All considered, there is a chance of occasional Minor Geomagnetic Storm G1 intervals for the remainder of the current UTC day, falling with time to a slight chance given the 'coronal hole'-sourced fast wind, and then perhaps a very minor glance from the 19 February CME in turn.

Energetic Particles / Solar Radiation: Solar radiation levels are most likely to remain at background levels, but with a slight chance of rising towards the S1 level, perhaps exceeding it should any larger X-ray flares occur.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	20	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	50	50	40	30
Very Active	R3 to R5 X	No	15	15	15	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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